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Extraction of impacted mandibular third molars - the effect of osteotomy at two speeds on peripheral bone: a histopathological analysis

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Abstract

The aim of this study was to find out the ideal speed for making a precise osteotomy with minimal damage to the surrounding bone. Thirty-six patients were divided into two groups (n=18 in each) depending on the speed of the handpiece used for osteotomy (slow=20 000 rpm and fast=40 000 rpm). Samples were taken from the peripheral bone and examined histologically to measure the margins of the osteotomy, the amount of debris produced, and the degree of thermal osteonecrosis. The osteotomy made with the high speed handpiece was better than that made with the low speed one on all counts. The margins in the high speed group were more or less precisely as required, with less debris and no thermal necrosis, which illustrated the efficacy of a high speed osteotomy. These findings can apply to other procedures that involve osteotomies in maxillofacial surgery.

Keywords: Third molar surgery; Impacted tooth; Osteotomy

Introduction

The methods of osteotomy have evolved continuously, with the aim to minimise the invasiveness of the procedure by allowing more precise cuts. The main concern in cutting bone is the mechanical and heat-related damage to the bone induced by high-speed cutting tools.[1]

In maxillofacial surgery osteotomies are made with high speed power tools during procedures such as extraction of teeth; fixation of fractures; orthognathic, craniofacial, and preprosthetic procedures; resection of bone; and placement of implants.[2] Disimpaction of impacted teeth is one of the most common procedures and the technique requires burs at high or low speed.[3,4] The reasons for complications associated with the extraction of impacted third molars can be equipment-related, and include speed of the drill, torque of the handpiece, and repeated use of the bur.[5,6]

Modern techniques of osteotomy such as the piezotome and hard tissue lasers have reduced the potential for trauma to adjacent structures.[2] However, the equipment is expensive and requires training, so they are not widely used.

The aim of the present study was to compare by histopathological examination of the osteotomy site the precision of the osteotomy, the amount of debris produced, and the amount of thermal osteonecrosis of the peripheral bone after either slow or fast drilling.

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Patients and methods

The study was done in the outpatient department of Department of Oral and Maxillofacial Surgery, Faculty of Dental Sciences, Sri Ramachandra University, and the protocol was reviewed and approved by the Ethics Board for human studies of Sri Ramachandra University, Chennai. Written informed consent was obtained from each patient who volunteered for the study.

Thirty-six healthy patients (18-40 years old) who presented to the Department of Oral and Maxillofacial Surgery, Faculty of Dental Sciences, between March and April 2014 with impacted, disease-free, mandibular third molars volunteered for this randomised, prospective study. The sample size was calculated using G*Power 3 software and the power set at 0.8. Pregnant women, smokers, and patients with systemic diseases, periodontal disease, or carious third molars were excluded.

Patients were randomly assigned into two groups of 18 each based on the rpm set using the electric motor (NSK Surgic AP Dental Electrosurgical Unit) of the surgical handpiece (NSK FX-65). In the slow speed group it was set at 20 000 rpm and in the high speed group at 40 000 rpm. The randomisation was done using Random Allocation Software, and all procedures were done by residents in the Department of Oral and Maxillofacial Surgery. The histopathological analysis was done by a single experienced pathologist who was unaware of which group each patient was in.

The Moore-Gillbe collar technique was used in all cases. All procedures were done under local anaesthetic (2% lignocaine with adrenaline 1:200,000, 3 ml) which was given through inferior alveolar, lingual, and long buccal nerve blocks. No other injections were given. The osteotomy was made with the surgical handpiece operating at the speed to which the patient had been allotted. The rotary bur was standardised and a HP 702 tungsten carbide bur was used. A new bur was used for every patient. External saline irrigation at 26 °C was used during all the osteotomies. After the tooth had been removed the peripheral bone was obtained from the distal aspect using a 2 mm trephine.

The specimen was then decalcified and stained with haematoxylin and eosin and studied under a light microscope. The margins of the osteotomy, the quantity of debris, and the degree of thermal osteonecrosis were assessed by an experienced oral pathologist and graded (Table 1). Margins denote the precision of the osteotomy, debris denotes the quantity of bone particles created during the osteotomy, and thermal necrosis present at the marginal bone was measured using a μm scale.

Statistical analysis was done with the aid of SPSS software (version 7.0, SPSS Inc, Chicago, IL, USA) and Fisher's exact test for small numbers was used to assess the significance of the differences between the groups.

Table 1
Grading of variables, and results (n=18 in each group).

Variable	Score	No in low speed group	No in high speed group
Margins:			
Smooth	0	-	8
Mildly irregular	1	12	10
Irregular	2	6	-
Debris:			
None	0	4	8
Minimal	1	-	10
Moderate	2	6	-
Severe	3	8	-
Thermal osteonecrosis:			
<5 μm	0	13	18
5 μm or more	1	5	-

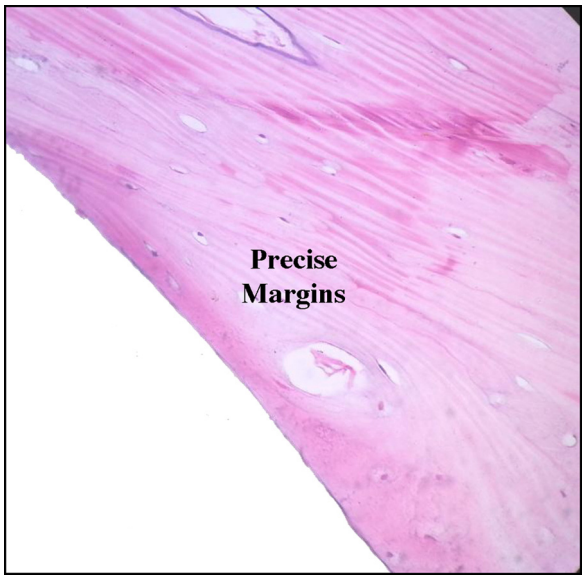

Fig. 1. Precise margin, high speed group (haematoxylin and eosin, original magnification x 40).

Results

The mean (range) age of patients in the low speed group was 28 (18–36) and in the high speed group 27 (19–40) years. There were eight men and 10 women in the low speed group, and 11 men and 7 women in the high speed group.

Margins

The margin scores were inversely proportional to the speed of the handpiece (Figs. 1 and 2). The scores are shown in Table 1, and the difference is highly significant ($p<0.001$).

Debris

A similar observation was seen in case of debris where the scores were inversely proportional to the speed of the handpiece (Figs. 3 and 4). Again the difference is highly significant ($p<0.000$) (Table 1).